MINISTRY OF HEALTH CARE REPUBLIC OF BELARUS
GOMEL STATE MEDICAL UNIVERSITY

Department of the General Hygiene, Ecology and Radiation Medicine

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MILITARY HYGIENE

The Manual
for 3-d-year overseas students
of General Medicine faculty

Gomel
GSMU
2008

УДК 613 : 355
ББК 51.2 : 68
3-80

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З-80 Военная гигиена: учеб.-метод. пособие для студентов 3 курса факультета по подготовке специалистов для зарубежных стран = Military hygiene: The Manual for 3-d-year overseas students of General Medicine faculty / А. В. Золотарева. — Гомель: Учреждение образования «Гомельский государственный медицинский университет», 2008. — 16 с.

ISBN 978-985-506-162-6

Настоящее учебно-методическое пособие предназначено для студентов медицинских вузов, обучающихся на английском языке. Состоит из двух разделов: «Санитарный надзор за водоснабжением войск в полевых условиях», «Санитарный надзор за питанием войск в полевых условиях», рассчитано на 8 часов практических занятий. Учебно-методическое пособие соответствует требованиям высшей школы.

Утверждено и рекомендовано к изданию Центральным учебным научно-методическим советом учреждения образования «Гомельский государственный медицинский университет» 13 июня 2008 г., протокол № 7.

УДК 613 : 355
ББК 51.2 : 68

ISBN 978-985-506-162-6

SECTION «MILITARY HYGIENE»

TOPIC 8. SANITARY INSPECTION OVER WATER SUPPLY IN TROOPS IN FIELD CONDITIONS

Urgency:

Examination of water in field conditions is the major action on sanitary-and-hygienic maintenance of troops. Health and fighting capacity of the whole military divisions depends on qualitative examination, especially in case of use by the enemy the weapon of mass defeat.

The purpose of class:

To master the bases of the organization and a technique of sanitary inspection over water supply in troops in field conditions.

Practical skills:

— To study the combined methods of water quality improvement.
— To familiarize with the basic organic means of field water supply in troops.
— To be able to carry out the hygienic control over water quality.
— To master a technique of water disinfecting in field conditions.

The basic educational questions:

1. The organization of water supply of troops in a peaceful time at barracks and camp accommodation. Duties of medical service.
2. The organization of water supply of troops in a wartime, duties of various services. Points of water supply and a diversion, hygienic requirements to their equipment.
3. Quantitative norms of water supply in field conditions for staff and military-medical establishments.
4. Requirements to water quality in field conditions.
5. Probable ways and the basic attributes of water infection in conditions of weapons of mass destruction application. Allowable sizes of infection of potable water by radioactive substances and toxic agents.
6. Organic means for organization of water supply in field conditions.
7. Duties of medical service on control over water supply in field conditions.
8. Individual means of water disinfection.
9. The elementary methods of water chlorination by normal and big chlorine dozes.

Teaching-material maintenance

1. Roentgenometer — radiometer ДП-5, ПХР-МВ.
3. Situational tasks.

The tasks for self- training and teaching — research student's work

1. The decision of situational tasks.

2. Acquaintance with the device and principle of operation of fabric-coal filter TUF-200.

Among the actions, providing health and fighting capacity of troops, water supply occupies one of the important places. There is always a danger of the use of any accessible water at sharply limited availability of good-quality water, especially at operations, that can complicate sanitary-and-hygienic conditions in troops.

The responsibility for troops maintenance with water in field conditions is lay on commanders of military units. Under their instruction water delivery of district, investigation of water sources, its extraction, quality improvement, storage, delivery and distribution to crew is estimated. Direct performance of tasks of field water supply of troops is organized by the chief of a military unit, the assistant to the commander on rear, chiefs of services - engineering, medical, radiation, chemical, biological protection.

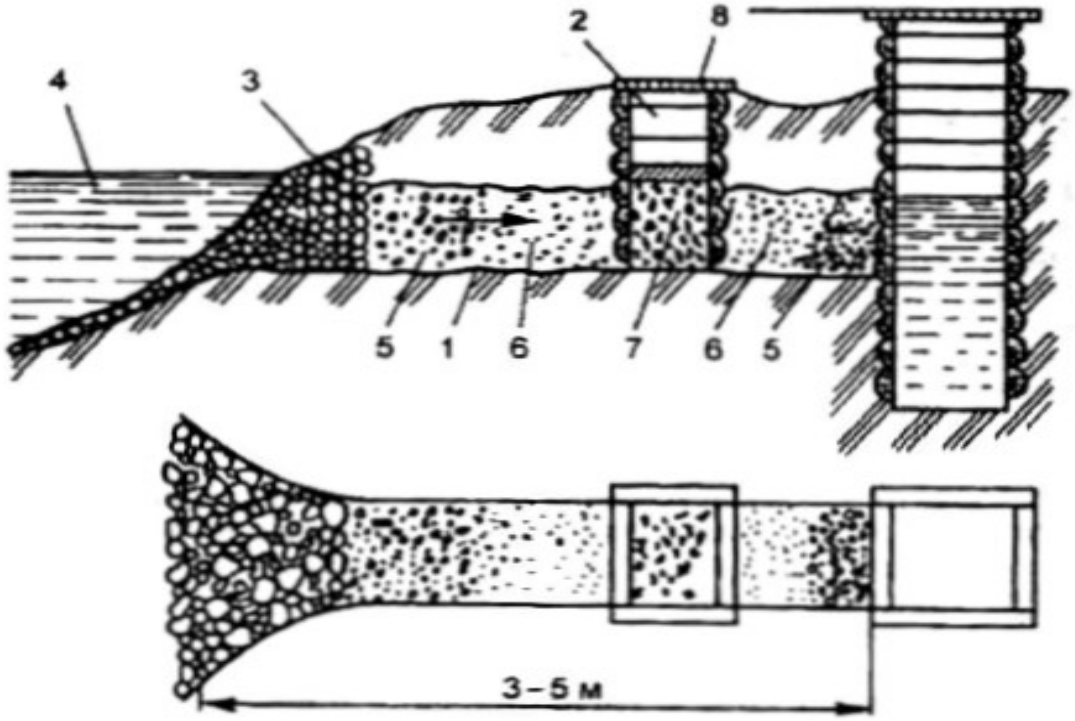

Figure 1 — Well with filtration trench

1 — фильтрационная траншея; 2 — колодец для древесного угля;
3 — каменная наброска; 4 — водоем; 5 — гравий; 6 — песок;
7 — древесный уголь; 8 — крышка колодца

Duties of medical service over water supply control in field conditions

The chief of medical service estimates sanitary-and-epidemic and epizootic condition in regions of points on field water supply and water intake points; organizes maintenance of troops with disinfection means of individual water

stocks, and also the medical control over a condition of points of field water supply, water intake points, water quality control, check of observance by military men of a drinking mode.

The medical service in field conditions carries out the control over the maintenance of the organic means, which belong to engineering service.

Organic means subdivide:

— **Means of extraction** of superficial bedding underground waters (up to 25 and 50 m) and deep (up to 200 m) bedding (fine tube well, mobile drilling rigs, pumps).

— **Means of clearing** (field filters, troops filtering stations, desalination water means, stations of complex clearing).

— **Means of transportation and water storage**.

At long water storage addition one mg of active chlorine on liter of water is necessary every second day.

There are also **organic means** for medical water quality control in field conditions.

The structure of army filtering station includes **field laboratory of water-purifying station** — FLWPS, intended for water research on all parameters and on presence toxic agents. Radioactive substances are determined with the help of a field dosimeter FD-5A.

Figure 2 — Laboratory medical field army

Hitherto are used FCL-54 (field chemical laboratory) and SHW (set hydrochemical water).

There is laboratory hygienic — LH-1 and medical field chemical laboratory — MFCL in a division in packing. With help LH-1 is possible to carry out 150 water researches on chemical parameters and 300 foodstuffs researches per day.

In sanitary-epidemic brigades water researches are carried out with help LH-2, which more powerful, than LH-1: carries out 300 water researches in day.

Toxic agents are defined with help MFCL, radioactive one — RLP-2 (radiological laboratory in packing).

There are the same means for water quality control in front, as in army.

It is necessary to emphasize, that water examination in field conditions — rather responsible action. It cannot be compared even to the most unique operation as health and life of many people depends on the careful, correctly carried out research.

Requirements to quality of water in field conditions

Before to speak about water quality, it is necessary to specify, that in field conditions water can be three kinds:

1. Water for preparation of food and drink.
2. Water for the economic — household purposes (washing of linen, crew).
3. Water so-called technical (for removal from military equipment, defensive installations toxic agents, radioactive compounds, bacterial weapon).

Requirements to potable water quality in field conditions a little differ from Sanitary norms and rules «Water drinking». For potable water the worse are supposed organoleptic properties (smack and smell), is higher the dry rest and should be more than residual chlorine. However at opportunity of application by the probable enemy of the bacteriological weapon (BW), toxins, spores of pathogenic microorganisms, in a wartime in potable water should not be any microorganisms at all, and the coli-index should be equal to zero. Is not established by a medical science yet, what minimal spores quantity can cause disease and for a guarantee are achieved microbes and their spores annihilation, that is quite achievable by modern means.

Figure 3 — Water-desalinating station

The following kinds of water treating in field conditions are carried out depending on a task in view: **clarification (decolouration, deodorization), disinfection, neutralization, deactivation and desalination.**

At each kind of water treating is used some ways of processing (ways of improvement of water quality).

For water **disinfection** in field conditions is applied boiling, chlorination, coagulation, sedimentation, filtering, the UV-irradiation and processing by special tablets. The control over observance of rules of disinfecting of water and supply by tablets is assigned by medical service.

Probable ways and the basic attributes of water infection in conditions of mass defeat weapon application. Allowable infection dozes of potable water by radioactive substances (RS) and toxic agents (TA)

Radioactive agents can get in the water, especially in open reservoirs, owing to application of the thermonuclear weapon, TA and BW — as with the help of various shells, aviation containers, and diversionary way, if in case of water pollution by TA and BW is possible to find out any attributes (oil stains, unusual smell, change of vegetation around of a water source, fauna destruction), RS indication owing to organoleptic properties absence in them and slow-acting on an organism is rather difficult.

In case weapon of mass defeat application in potable water RS and TA presence is allowed. RS content is regulated by the Order of Defence Minister N 310 (1983) «About estimation of nuclear explosion consequences on staff of troops, fleet forces, formations of a civil defence and the population», according to which doze capacity on kettle of water should be no more than 14 mr /hour, on bucket of water — no more than 40 mr /hour. Term of consumption — one day. If consumption term more than 30 day, dose rate should be in 10 times less: accordingly 1,4 and 4 mr /hour.

TA is allowed in potable water in the following quantities: yperite of — 0,1 mg / litre, lewisite — 0,06 mg / litre. Phosphoorganic compounds and V-gases in the water, intended for drink and food preparation, are not allowed.

Economic — household water should be free from pathogenic microorganisms, though it can contain RS and TA in fair quantities, but is not higher than maximum permissible concentration for such water.

Technical water also should not contain pathogenic microorganisms, RS and TA can contain in allowable quantities for technical water.

Extemporaneous means for water purification in field conditions. The elementary methods of water chlorination by prof. Drachev's and Cherkinskiy's method

In conditions of modern war the big losses are assumed among staff, including various services, so the use of extemporaneous means in addition to organic for water purification important also: device of fabric-coal or sand-coal filters, the organization filtering wells near to open reservoirs.

Extemporaneous means, more often boilers of field kitchens, can be used for transportation and temporary storage of water in field conditions.

During Great Patriotic War well showed itself introduced ways of water disinfecting are suggested by professors Drachov and Cherkinskiy. With the help of these ways is made, mainly, a choice of a chloride lime doze, necessary for chlorination of this or that water quantity.

Chlorination of water by method of professor Drachev is made by normal chlorine dozes. All waters on organoleptic properties are divided on two groups:

1. Colorless, transparent.
2. Muddy, painted.

Are taken three buckets of water (on 10 litres). In the first bucket is added one teaspoon of a 1 % chloride lime solution, in the second — 2 teaspoons, in the third — 3. In 30 minutes residual chlorine is defined on a smell and is choosed bucket which water has a weak chlorine smell. This bucket specifies the chlorine doze necessary for chlorination of 10 litres of water. Quantity of chlorine is calculated for all water volume subject to chlorination. If the chlorine smell will not be found out in any bucket or in all buckets will be sharp, chlorination is repeated with new portion of water, adding chloride lime half less or twice more.

Water chlorination by method professor Cherkinskiy represents the simplified superchlorination method.

All waters are divided on three groups:

1 — water of felled wells-transparent and colorless;

2 — the muddy and appreciablly painted water from the rivers and lakes;

3 — water of ponds and dams not drinking assignment.

On every 10 buckets is taken one, two, three teaspoons of dry chloride lime (depending on group), preliminary dissolved in a mug with a small water amount.

Contact — 15 mines, then water is dechlorinated, by 0,5 or one teaspoon hyposulphite depending on chloride lime spoons quantity (in 2 times more). It is possible to hyposulphite water by passing it through the pure activated coal.

Chlorination of water by normal dozes of chlorine

In some cases in field conditions water chlorination is carried out by normal dozes of chlorine. It happens at water intake from well-investigated, safe in the epidemic attitude, long-exploited water sources. Chlorination carry out the allowed chlorine-containing preparations — neutral calcium hypochlorite (NCH) — 70 % of active chlorine, two thirds basic salts of calcium hypochlorite (TTS CH) — up to 55 % of active chlorine, etc. Thus are applied two ways: chlorination by normal dozes and super chlorination — use of the big dozes. Last way is more preferable.

For water chlorination by normal dozes of chlorine is necessary to define percentage of active chlorine in chloride lime, to carry out test chlorination with the purpose of definition chlorine demand in water and to determine disinfection efficiency under the residual chlorine concentration in chlorinated water.

Definition of chloride lime activity

For definition of activity from different places of container is selected 300–500 g chloride lime, carefully mixed and from the received average test weighed out on pharmaceutical scales 1g.

This quantity chloride lime is poured into porcelain mortar, added a small amount of distilled water and grinded in homogeneous gruel, dilute with distilled water and pour in a measured flask on 100 ml. Rinse some times a mortar and a pestle with distilled water which also merge in graduated flask, and lead up quantity of a liquid in a flask to a mark.

The prepared 1 % chloride lime solution must be settled within 5–10 minutes. From the clarified part 5 ml solution is taken by a pipette and transfer to a conic flask, where flowed to 50 ml distilled water, 5 ml of 5 % solution potassium iodide and 1 ml dissolved 1:3 hydrochloric acid. Active free chlorine force out from potassium iodide iodine, which quantity is equivalent to chlorine. Allocated iodine is titrated by 0,01 n thiosulfate solution untill weak — yellow colouring, 1 ml 1 % starch solution is added and titrated untill disappearance of dark-blue colouring.

If 1 ml 0,01 n thiosulfate solution connects 1,269 mg iodine, that equal to 0,355 mg of active chlorine; after multiplication 0,355 on thiosulfate quantity, used for titration, received chlorine quantity in 5 ml of 1 % chloride lime solution. For definition of the chlorine content in 1 ml chloride lime solution result is divided on 5.

In 1 ml of 1 % chloride lime solution contains 0,01 g or 10 mg dry chloride lime. For calculation of chloride lime activity, which is expressed in percentage, the proportion is made:

0,01 g chloride lime — Y g active chlorine.
100 g chloride lime — X g active chlorine.

where Y — the content of active chlorine in 1 ml of 1 % chloride lime solution or in 0,01 g dry chloride lime;

X — the content of active chlorine in 100 g dry chloride lime.

It follows that

$$X = \frac{Y \times 100}{0{,}01}$$

As active chlorine is calculated in 100 g chloride lime, the received result expressed in percentage.

Definition chlorine demand of water. In field conditions the accelerated method is applied for chlorine doze definition with the help of three glasses. In three glasses is poured on 200 ml of water for which it is necessary to define **chlorine demand**. 1 % chloride lime solution is added by a pipette: in the first glass — 1 drop; in the second — 2 drops; in the third — 3 drops. Water is well

mixed and leaved for 30 minutes. Then in all glasses is added on 10 drops of 5 % potassium iodide, 2 ml dissolved 1:3 hydrochloric acid, mixed and added 1 ml of 1 % starch solution. In those glasses, where there is residual chlorine, free iodine is evolved, which at the starch presence paints water in dark-blue color.

In glasses is added on drops of 0,7 % sodium thiosulfate solution by pipette, starting with a glass with the least colouring. Water is carefully mixed after addition of each drop. One drop of 0,7 % sodium thiosulfate solution connects 0,04 mg of chlorine. If water in a glass has become colourless from one drop, means, residual chlorine in 200 ml of water are less or equal 0,04 mg, and in litre — 0,2 mg, that is insufficient quantity are less than or equal. Residual chlorine in the following two glasses is similarly defined.

If after trial chlorination is not revealed enough of residual chlorine in any of glasses (it possible at big chlorine demand of water), research is repeated. Glasses again are filled with water. Then in the first glass is added 4, in the second — 5, in the third — 6 drops of 1 % chloride lime solution and in 30 minutes again residual chlorine is defined. For calculation is choosed that glass, where decolouration has taken place from 2 drops sodium thiosulfate (0,2–0,7 mg of residual chlorine).

If water is given out from water supply point, it should contain about 1 mg /litre of residual chlorine.

If is known, how many drops of 1 % chloride lime solution it has been entered into the chosen glass, is calculated chloride lime solution quantity, necessary for chlorination of known water quantity. At recalculation on dry chloride lime it is necessary to take into account, that 1 ml of 1 % solution contains 10 mg chloride lime.

Identically residual chlorine is defined in chlorinated water.

TOPIC 9. SANITARY INSPECTION OVER NUTRITION IN TROOPS IN FIELD CONDITIONS

Urgency:

Sanitary inspection over nutrition of military men is one of main directions in practical work of all parts of medical service from control of sanitary condition in dining rooms and all crew health, participial to nutrition provision of crew of each military unit, up to the decision complex scientific and organizational problems of a military hygienic regulation. The purpose of such control is preservation and strengthening of people health by the prevention of diseases and organism disorders, connected with the use of low-grade food, to its insufficient quantity, imbalance of structure, a wrong mode and unsatisfactory conditions of nutrition.

The purpose of class:

To master the organizational bases and a sanitary inspection technique over nutrition of troops in field conditions.

Figure 4 — Food point of battalion deployment

Practical skills:

— To learn to select tests of ready food for definition of a chemical compound and energy value.

— To be able to carry out sanitary examination of foodstuff of army assortment.

— To familiarize with the organic means of medical service used for carrying out of sanitary examination of foodstuff, infected by radioactive substances (RS) and toxic agents (TA).

The basic educational questions:

1. Organization of nutrition of troops and tasks of medical service.
2. The basic soldier's ration, its hygienic estimation and versions.
3. The organization of the sanitary-and-hygienic control over nutrition of troops in barracks quartering.
4. Prophylaxis of vitamin insufficiency and poisonings in troops.
5. Organization of nutrition of troops in a wartime. Field food points. A nutrition in conditions of weapons of mass destruction application.
6. Protection of food stuffs from TA, RS and bacteriological weapons (BW).
7. Sanitary examination of the foodstuffs. Allowable sizes of products infection by TA and RS.
8. Methods of deactivation and neutralization of the foodstuffs and containers.

Are distinguished 2 kinds of the control over nutrition: **non-laboratory and laboratory.**

Non-laboratory methods are subdivided:

1. The control on a food chain. The control over completeness of products reception from a warehouse, delivery in division, completeness of laying in the

dixie is carried out, completeness of portion distribution and the food rests on tables are taken into account. Simple interrogation will give the explanatory, why the food rests are remained on tables.

2. The control over physical development.

Table 1 — Assessment criteria of nutritional status for military personnel

Nutritional status	Body weigh index	
	18–25 years	26–45 years
Deficient nutrition	< 18,5	< 19,0
Decreased	18,5–19,4	19,0–19,9
Normal	19,5–22,9	20,0–25,9
Increased	23,0–27,4	26,0–27,9
Obesity I level	27,5–29,9	28,0–30,9
— II level	30,0–34,9	31,0–35,9
— III level	35,0–39,9	36,0–40,9
— IV level	40,0 and >	41,0 and >

3. Calculation-and-documentary. The menu — apportionment is made by the chief of food supply service, the shelf will be coordinated by the doctor and affirmed by the unit commander. For competent representation it is necessary to know:

— Which norms of a daily allowance are used for nutrition, it is the basic ration or its version.

— The plan of work of military unit in the certain time intervals. If not field studies are stipulated the caloric food value can be lower, than 4174 kcal, for instance, 3800 kcal. If for second day field studies are stipulated missing calories these days are thrown for the previous day. If someone goes on night duty caloric content of a dinner is transferred to a supper.

At the control of menu — apportionment during more long time interval should be carried out its correct choice. Menu for holidays and the days off usually are not chosen; if the menu's estimation is made during year, then are chosen not less than 80 menus, accordingly for each season — not less than 20 menus.

The weight of products is indicated in menu – apportionment in gross, therefore it is necessary to take into account waste products. It is necessary to take into account caloric content, the quantitative composition (the contents of proteins, fats, carbohydrates), the qualitative composition of a nutrition (the ratio of calcium and phosphorus, proteins and fats animal and vegetable); caloric content of a breakfast, a dinner and supper is estimated. It is possible to find out products assortment, replacement of them, repeatability of dishes and conditions of thermal processing of products. Foodstuff can be replaced: a meat — by fish, vegetables — by groats, on the contrary, etc. Replacement possibly no more than during three days, further missing products should be delivered in military unit.

One of not laboratory control methods is weighing dishes and matching to dishes of test cooking. Thus the food output and relative density of the dense rest is taken into account also, for instance 40–50 % — in the first dishes. Test cooking is carried out once a month, and its nutrition engineer of command

carries out. At culinary processing some products can be decreased in weight.
Table 2 — Daily ration

Food products	Quantity, gram	Food products	Quantity, gram
Tea	1,2	Oil	40
Groats (different)	120	Sugar	70
Pepper	0,3	Butter	30
Bread rye	350	Potatoes, vegetables	900
Bread white	250	Salt	20
Macaroni	40	Fish	100
Bun	100	Juice	50
Meat	200	Milk	100
Eggs	4/ week	*Caloricity*	*4180*

Value of research is considerably improved, if chemical research is spent, i. e. the laboratory method (not less often, than once in a month) is used. Tests for the analysis are selected by the commission. Its structure includes the representative of medical service, the chief of food supply service, the attendant on kitchen. On the laboratory analysis ready dishes are selected: the snack, the first, the second, the third. Other products, not exposed to culinary processing, are investigated then, when there is a suspicion on deviations from the established standards. Food is taken from different tables, not less than 10 portions, mixed, selected an average portion after weighing, put in utensils, closed, affixed a seal, attached a label with date and time of a capture, with the indication of military unit, dish name. Tests are directed to laboratory together with the certificate (act) and a copy of menu – apportionment. Divergences between the menu and the data of laboratory research are supposed ± 10 %. For food products, which are not demanding culinary processing (bread, oil, sugar), divergences are not supposed at all.

It is possible to judge nutrition on a health state of military men is one of methods of nutrition estimation. **About trouble in nutrition testify:**

1. Occurrence of diseases, including infectious.
2. Decrease of workability and inability to perform work in extreme conditions.
3. Decrease of ability to training.
4. Appearance of apathy, absence of tendency to reception of usual information volume.
5. Biochemical tests can give judgement about nutrition quality. In particular, content amino acids, vitamins, them metabolites, fats, etc. in biological liquids.

Sanitary examination of the foodstuff, allowable sizes of products contamination by TA and RS

Sanitary examination of the foodstuff includes organizational and special actions, which are carried out with a view of definition of products suitability for a nutrition.

Foodstuff examination have some stages.

The first stage — sanitary-and-hygienic examination of food service object. It can be carried out by the food service or during patrol with the purpose of an establishment of applied weapon, what influence it rendered on the foodstuffs. At the same stage sorting of the foodstuffs — division into groups is carried out according to nutrition suitability, that in many respects depends on protective properties of container and packing. 3 groups are allocated:

1-st group — the foodstuffs, which is suitable for a nutrition without laboratory researches; packed into tight container and packing — flanks with a double bottom, paper bags with the two-layer loose leaf from polythene.

2-nd group — the foodstuffs, which does not require research, but obviously is not suitable for nutrition: groats and vegetables without packing.

3-n group — the foodstuffs of doubtful quality: property of container does not provide reliable shelter.

The foodstuff not always manages to be divided into three groups. Then division is made into two groups — suitable, not suitable for nutrition, thus a product of doubtful suitability refer to unsuitable.

The second stage of examination — sampling. Tests are selected from 10 places, weight of each test — not less 400 g. Coupon of a product packed up in a polyethylene bag, the bag is overwound and put in another one with finishing same procedure. The polluted foodstuff are selected with observance of all safety measures.

The third stage — researches. First of all sanitary — microbiological test is carried out (with biological test), for what thermostats are required, laboratory animals and time. Results are received as a minimum only in 2–3 day. Further it is carried out sanitary — radiological and general-sanitary (definition of physical, organoleptic, chemical properties) researches.

The fourth stage — the conclusion, in which should be foodstuff suitability for a nutrition is legibly determined.

The formulation of the conclusion can be three kinds:

1. The foodstuff is suitable for crew nutrition.

2. The foodstuff is not suitable for crew nutrition.

3. The foodstuff temporarily is not suitable, repeated research is required in 2–4 days (usually at products pollution by fission products or TA).

If the foodstuff is not suitable for crew nutrition, then the medical service cannot draw conclusion about destruction, the decision is accepted by the commander of division, then the commission is created with inclusion of the persons responsible for material provision.

In wartime in foodstuff can present TA, RS and BW. There is a special instruction of Minister of Defence on allowable RS and TA quantities in

foodstuff. In liquid and loose products radioactive pollution in the following quantities is supposed: on a bucket of a product — 40 mr /hour, on kettle — 14 mr /hour, loaf of bread — no more than 14 mr /hour. To consume products of this radio-activity degree it is possible within day, if more than month — the doze should be lower in 10 times — accordingly 4 and 1,4 mr /hour.

Presence of poison gases is supposed: yperite — 0,1 mg / kg of the foodstuffs, nitrogenous yperite — 0,04 mg / kg, lewisite — 0,06 mg / kg; phosphoorganic compounds (sarin, soman) and vi-gases in food stuffs should not contain.

Research of foodstuff begins in sanitary — antiepidemic squadron, where there are dosimeters and the medical device of chemical investigation; research proceeds in sanitary — antiepidemic squadron of army, if necessary — in front's subdivision.

Учебное издание

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ВОЕННАЯ ГИГИЕНА
(на английском языке)

Учебно-методическое пособие
для студентов 3 курса факультета
по подготовке специалистов для зарубежных стран

Компьютерная верстка *А. М. Елисеева*

Подписано в печать 21. 07. 2008
Формат $60\times84^{1}/_{16}$. Бумага офсетная 65 г/м^2. Гарнитура «Таймс»
Усл. печ. л. 0,93. Уч.-изд. л. 1,0. Тираж 100 экз. Заказ № 236

Издатель и полиграфическое исполнение
Учреждение образования
«Гомельский государственный медицинский университет»
246000, г. Гомель, ул. Ланге, 5

ЛИ № 02330/0133072 от 30. 04. 2004